METHOD AND APPARATUS FOR DISTRIBUTING COLOR CORRECTED IMAGES ACROSS A NETWORK USING DISTRIBUTED CACHING

RELATED APPLICATIONS

5   [0001]   This application claims the priority of provisional application serial no. 60/195,658, filed April 7, 2000.

BACKGROUND OF THE INVENTION

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1. Field of the Invention

[0002]   This invention relates to image delivery over a network and more specifically to delivering color corrected images using distributed caching.

15   2. Description of the Prior Art

[0003]   Color correcting images for delivery to users through a network generally relies on knowledge of each user's system. Thus color corrected images are usually prepared individually for each user according to the characterization of the user's system, and are not generally cacheable. Some systems create multiple versions of images for delivery over a network. What is needed is a technique of correcting and delivering images over a network that is compatible with distributed caching and would permit users having similarly characterized systems to receive similar images from distributed caching and thus optimize image delivery.

SUMMARY OF THE INVENTION

[0004]   The invention provides a method for
distributing images and other content over a network
whereby multiple versions of an image, color corrected for
5   individual classes of users, are integrated with a content
distribution network so that these multiple image versions
are dispersed geographically over different caching servers
connected to the network. Color corrected images may be
combined with regional caching solutions to speed the
10   delivery of the images to the end user. Regional caching
solutions use the URL of the image to tag it as cache-able
and optionally can provide information to the caching
service to improve the efficiency of caching. In a first
aspect, the present invention uses information in the URL
15   to color correct an image. By combining the information
needed for caching with the information needed for color
correction, the present invention can work in conjunction
with distributed caching systems to provide regionally
cached, color corrected images.

20   [0005]   In another aspect, the present invention
provides a system that can be delivered with many caching
servers distributed worldwide and one central color
correction server or it can be delivered with multiple
color correcting and caching servers distributed worldwide.
25   In both cases color corrected images can be delivered to
the end user faster than a solution that does not combine
color correction and distributed caching, or color
correcting alone.

[0006]   Thus, in one aspect, the present invention
30   provides a method for distributing color corrected images

over a computer network to a client computer by receiving

an image request from the client computer, selecting a

color corrected image from a cache of color corrected

images in response to the request wherein each image in the

5   cache is corrected according to one of a finite number of

sets of image display characteristics, and forwarding the

image request to a color server to select an image in

response to the request when an image cannot be selected

from the cache in response to the request. Further, an

10   image provided by the color server in reply to the request

may be stored in the cache of color corrected images for

later use as well as forwarded to the client computer.

[0007]   In another aspect of the invention, a

15   computer network for distributing color corrected images to

a client computer comprises a cache of color corrected

images, each image corrected according to one of a finite

number of sets of image display characteristics; a caching

server to receive an image request from the client computer

20   and connected to the cache to select a color corrected

image from the cache in response to the request; and a

color server connected to the caching server to receive the

image request and to select an image in response to the

request when the caching server cannot select an image from

25   the cache in response to the request.

[0008]   These and other features and advantages of

this invention will become further apparent from the

detailed description and accompanying figures that follow.

30   In the figures and description, numerals indicate the

various features of the invention, like numerals referring

to like features throughout both the drawings and the description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]   Fig. 1 is a block diagram of a computer
5 network according to the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010]   Referring now to Fig. 1, system 10 according
to the present invention provides color images from network
10 servers to users, enhanced when possible, with user
specific color correction information to provide high
fidelity color images to the users. In particular, in
accordance with a preferred embodiment of the present
invention, color server 28 may provide color catalog pages
15 for clothing or other products to a potential buyer, such
as user 14, adjusted to provide high fidelity color images
in accordance with the color display characteristics of
display 14D.

[0011]   In general, system 10 may include one or
20 more network servers and one or more users. Network
servers may include color server 28, commercial server 24,
and caching server 26. Users may include users 14 and 30,
interconnected to network servers using network 12.
Network nodes such as color server 28 may serve as a user
25 or client for some purposes and a server for others.
System 10 does not require a static server, constantly
functioning as a server, in all embodiments.

[0012]   Network 12 may be any type of network such as a LAN, intranet or an internet such as the World Wide Web (WWW). Network 12 may also utilize any type of appropriate network protocol, such as HTTP as used on the

5   World Wide Web. Color server 28 may be used to host color correctable images 50 to be made available to users of commercial or other network sites. Caching server 26 may also be used to host color corrected images according to the present invention.

10   [0013]   User 14 may be any conventional network client device and may include one or more electronic devices 14A, conventionally a personal computer or workstation, and one or more display devices 14D, conventionally a CRT or LCD display monitor. User 14 may

15   also include remote storage 14R and or local storage 14L within electronic device 14A. Remote storage 14R may also be available to electronic device 14A through network 12. User 14 may also include one or more output devices, which may be any type of printer, recorder or plotter. User 14

20   may also include one or more input devices, which may be any type of scanner, reader, image capture device or other data transfer device.

[0014]   Delivery of color corrected data 40 according to the present invention begins with request 16

25   sent to commercial server 24 for the display of an image on monitor 14D. Request 16 may originate with user 14 or any other network device such as commercial server 24. Image request 16 may be an individual request for a specific image, graphic, drawing, rendering or similar data file or

30   it may be part of a larger data request such as a web page

request. According to the present invention, commercial

server 24 may respond to image request 16 by transferring

non-color data 18 to user 14. Non-color data 18 further

includes one or more addresses 18A for color corrected

5   images such as image 40A to be combined with data 18D to

satisfy request 16.

[0015]   If display calibration or characterization

data 42 is available to commercial server 24 or to color

server 28, a color corrected version of image 40A may be

10   provided to user 14 in accordance with data 42. Thus,

image 40A as then displayed on display 14D may be a more

accurate color representation of a reference or author

image, image 44, than may otherwise be achieved.

Concurrent with delivery of color corrected images, display

15   14D may present a visual or other indicator 46, indicating

that the image or images being viewed are color corrected

and accurate. Indicator 46, or a variation thereof, may

also be used to indicate when images are not color

corrected and/or provide other information to user 14. An

20   online shopper or other user may have increased confidence

to make purchases, as a result of viewing image 40A over

network 12, knowing the color of image 40A as actually

viewed is accurate.

[0016]   By converting calibration or

25   characterization data 42 into a request such as image

request 20, caching server 26 may receive enough

information to provide 14 with a color corrected image.

Network users such as user 14 may be grouped to permit

multiple users to retrieve cached images from caching

30   servers such as caching server 26. The users may be

grouped into subsets according to their image display
characteristics so that correction of images is limited to
a finite number of perceptually uniform subsets. Each
subset is selected so that a single image provided to all
5   users within the subset is perceptually identical (or
nearly identical) to all users within the subset. Thus,
caching server 26 may store a finite number of pre-
corrected images among which to select an image in response
to an image request from a user 14 based upon the subset to
10   which the user has been assigned, as dictated by the user's
image display characteristics.

[0017]   By incorporating information on a users
characterization data and/or color correction group, cached
15   images may be delivered. The incorporated information may
be formatted to resemble an object to conform to network
addressing requirements such as WWW URL's. One embodiment
of URL addressing according to the distributed content
caching method of the invention is as follows. The first
20   step is to combine the distributed caching information and
the color correction information into a single image
request, using URLs to encode the two types of information.

[0018]   An image URL:
25   http://www.MyWebSite.com/public/mandrill.jpg

[0019]   The image URL with color correction
information encoded:
http://MyWebSite.imager.trueinternetcolor.com/Ima
30   geServer/ViewingProfile_100_125_130_200/Image_htt
p_www.MyWebSite.com/public/mandrill.jpg
where

- http://MyWebSite.imager.trueinternetcolor.com/ImageServer
  is the location of the color correction server

- /ViewingProfile_100_125_130_200 is the color correction
  information

5 - /Image_http_www.MyWebSite.com/public/mandrill.jpg is the
  image to be color corrected

[0020]   The image URL encoded for distributed
caching:

10   http://a500.g.akamai.net/7/500/404/106b0276/www.M
           yWebSite.com/public/mandrill.jpg

where

- http://a500.g.akamai.net is the location of the caching
  server

15 - /7/500/404/106b0276/ is caching specific information

- www.MyWebSite.com/public/mandrill.jpg is the image to be
  delivered from cache

[0021]   The image URL encoded for both color

20 correction and distributed caching:

           http://a500.g.akamai.net/7/500/404/106b0276/MyWeb
           Site.imager.trueinternetcolor.com/ImageServer/Vie
           wingProfile_100_125_130_200/Image_http_www.MyWebS
           ite.com/public/mandrill.jpg

25 where

- http://a500.g.akamai.net is the location of the caching
  server

- /7/500/404/106b0276 is caching specific information

- /MyWebSite.imager.trueinternetcolor.com/ImageServer is

30   the location of the color correction server

- /ViewingProfile_100_125_130_200 is the color correction information

- /Image_http_www.MyWebSite.com/public/mandrill.jpg is the image to be color corrected and delivered from cache

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[0022]   Another embodiment of URL addressing may be as follows.

[0023]   The image URL with color correction information encoded:

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http://MyWebSite.imager.trueinternetcolor.com/Ima geServer/Protocol_3dCSP_2c100_26Method_3dGetCorre ctedImage_26Customer_3d2000_26ViewingProfile_3d10 0_5f0_5f0.000_5f0.000_5f0.000_5f0_26Image_3dhttp_

15

3a_2f_2fwww.MyWebSite.com_2fpublic_2fmandrill.jpg

[0024]   The image URL encoded for distributed caching:

http://MyWebSite.geo.trueinternetcolor.com/public

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/mandrill.jpg

[0025]   The image URL encoded for both color correction and distributed caching:

http://MyWebSite.geo.trueinternetcolor.com/ImageS

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erver/Protocol_3dCSP_2c100_26Method_3dGetCorrecte dImage_26Customer_3d135724_26ViewingProfile_3d100 _5f0_5f0.000_5f0.000_5f0.000_5f0_26Image_3dhttp_3 a_2f_2fwww.MyWebSite.com_2fpublic_2fmandrill.jpg

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[0026]   In both of the above embodiments the request 20 for the color corrected image is handled first by the

distributed caching system, which attempts to fulfill the request if it is stored in the local cache. If the image is not stored in the local cache, the caching server 26 passes the request to the color correction server 28. The

5   color correction server performs the color correction on the image and returns it to the caching server. The caching server fulfills the initial image request and then stores the color corrected image in its cache for future requests.

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[0027]   The method of the invention may employ more than one content distribution network for geographic caching, and may further select the appropriate network based on performance, bandwidth pricing, network load, or

15   other relevant characteristics. The method of the invention is not limited to images intended to be viewed on the internet, but could equally apply to images for print on a network-connected print device or other output device. The method of the invention may also be used in geographic

20   caching systems for distributing multiple copies of audio, multimedia, taste, touch, or olfactory files — each adjusted for sensory correctness and distributed via a geographic caching service. The invention could also apply to files adjusted by image resolution or other non-color

25   image characteristics, with these plurality of files geographically cached using a content distribution network, or a plurality of content distribution networks.

[0028]   Having now described the invention in

30   accordance with the requirements of the patent statutes, those skilled in this art will understand how to make changes and modifications in the present invention to meet

their specific requirements or conditions. Such changes and modifications may be made without departing from the scope and spirit of the invention as set forth in the following claims.